Biomass Heating and Electricity Production:

A Guidebook For Rural Communities In Canada

CANADIAN MODEL FOREST NETWORK

RÉSEAU CANADIEN DE FORÊTS MODÈLES

Erin Neave
Prepared for the Canadian Model Forest Network
March 2013

Biomass Heating and Electricity Production:
A Guidebook For Rural Communities In Canada

ISBN 978-1-926619-05-7

Acknowledgements

This Guidebook was prepared by Erin Neave for the Canadian Model Forest Network through the support of the Forest Communities Program.

The author gratefully acknowledges the guidance of Mark Richardson (Eastern Ontario Model Forest) and Leanne Elliott (Canadian Model Forest Network) in the preparation of this guide. Peter Hall, Science Advisor to the Eastern Ontario Model Forest and Christopher Rees of Suthey Holler Associates provided a technical review. Elizabeth Holmes (Eastern Ontario Model Forest) also provided a final plain language edit. A Steering Committee consisting of members of the Canadian Model Forest Network and technical experts also provided guidance and resources in the initial stages of the project.

Members of the Steering Committee included:

Susan Carr: Prince Albert Model Forest
Sean Dolter: Model Forest of Newfoundland and Labrador
Peter Hall: Eastern Ontario Model Forest
Lisa Ladd: Weberville Community Model Forest
Clara Lauziere: Northeast Superior Forest Community
Mike Slivitzky: Natural Resources Canada
Larry Stanley: Saskatchewan Ministry of Energy and Resources
Kathi Zimmerman: Resources North Association

Table of Contents

Introduction

Canada is a resource rich country, supporting a wealth of renewable and non-renewable resource industries. Canadians are stewards to a large portion of the world's temperate and boreal forests. These forests provide a range of ecological services: from water purification and storage, erosion and flood control and air quality protection, to the provision of wildlife habitat. Forests also play a critical role in climate change mitigation, with Canadian forests sequestering an estimated 95 billion tonnes of carbon. Forests provide a range of economic values: from traditional forest products, recreational values and trapping, to the potential for energy production.

The past five years have been difficult ones for the forest industry in Canada and the rural communities it supports. A combination of high energy costs, the decline in the United States economy, increased competition, and shifting demand for traditional commodities (especially newsprint), have all conspired to create challenges like no other period in the industry's history. Indicators point toward a continuation of this trend, although new opportunities for industry diversification are beginning to emerge.

Communities are looking for mechanisms to reduce energy costs, foster a thriving or renewed forest sector and reduce dependence on fossil fuels. Most communities have heard about bioenergy, and the industry has been growing steadily in response to concerns over global and local energy security and climate change. Woody biomass can be used as an energy feedstock on its own, to generate heat, electricity or biofuels. It can also be used in combination with other energy sources such as coal and natural gas to co-fire for electricity generation.

The Canadian Model Forest Network (CMFN) is committed to fostering opportunity and investment in bioenergy production. It is also committed to contributing to the development of effective policy and programs at both the provincial and federal level.

The CMFN represents fourteen non-profit member organizations nation wide and is working to bring together information, tools and best practices to help forest-based communities overcome obstacles that affect their long-term social and economic well-being. With the support of the Forest Communities Program (FCP) and other partners, the CMFN is working to address challenges facing the forest community and to advance emerging opportunities.

About this Guidebook

The CMFN has developed a three-pronged approach to help community leaders, local businesses, non-profits and others in forest-based communities to assess bioenergy options for woody biomass that could offset their dependence on fossil fuels, while at the same time building capacity to meet the opportunities and challenges of a forest sector in transition. The approach includes:

1. A guidebook that provides a general overview of the process involved in converting woody biomass to energy. The guidebook is intended to get communities thinking about the process and to direct readers to the associated CMFN bioenergy website. The guidebook will be updated periodically as additional information becomes available.

2. The website (www.woodforenergy.ca) will provide greater detail regarding existing projects and technologies, federal and provincial policies and programs, and linkages to other relevant resources. The website will be updated on an ongoing basis.

3. The website will also provide a delivery platform for a decision support tool: 'A Bioenergy Options Evaluation Module for Communities.' This proprietary tool with log-in will lead a community through a series of questions, in order to collect information on community needs and capacity for a bioenergy project.

The three-pronged approach is intended to help communities evaluate their potential to produce energy through non-traditional fuel sources. The approach will also provide communities with unbiased information to help inform discussions with commercial interests.

This guidebook is intended to be a general resource, providing an introduction to energy from woody biomass with a focus on opportunities for communities for heat and combined heat and power projects. Introductory information is provided under each subject heading to get the reader thinking about the process, the benefits and the potential limitations. The guidebook has been produced for a national audience, which presents its own challenges, as opportunities and limitations vary considerably by region in Canada. The website is designed to provide a greater regional context and readers are encouraged to visit the CMFN site (www.woodforenergy.ca) for more information relevant to their own region. Greater detail and technical material is also referenced on the website.

What is Bioenergy?

Bioenergy is the energy released from recently living organic material or biomass when it is used as a fuel. Living plants use solar energy to combine carbon dioxide, water and soil minerals into plant material through the process of photosynthesis. The result is plant material made up of energy-rich carbohydrates, oils and fibres. Types of biomass that can be used to produce energy include wood, agricultural crops, plant residues and many other biological materials. This guidebook focuses on woody biomass sources, which are rich in cellulose fibres.

Most people intuitively understand the idea of bioenergy. People have been using biomass to produce heat for centuries. Over 3 million Canadians still use wood to heat their homes and in some parts of the world biomass remains the primary source of heat.

At a larger scale, the paper and wood products industries have been generating steam or hot water and electricity from woody biomass at an industrial scale for many years. Wood waste and byproducts such as 'black liquor' from the process of pulping wood are important biomass fuels contributing significantly to the energy needs of the industry. Some Canadian communities are also using woody biomass, to provide heat, or combined heat and power (cogeneration), to larger facilities and multiple buildings. This guidebook focuses on community applications at this scale.

Projects with a much larger scale are also beginning to emerge in Canada where woody biomass is used alone, or in combination with another fuel source (e.g., co-fired with coal or natural gas) to provide electricity to the power grid (distributed power).

Is Energy from Woody Biomass a Renewable Source?

One of the key drivers creating interest in biomass energy from wood relates to its link to a renewable, sustainable resource base. Interest in renewable energy sources is growing as a result of the need to address climate change impacts associated with the use of fossil fuels.

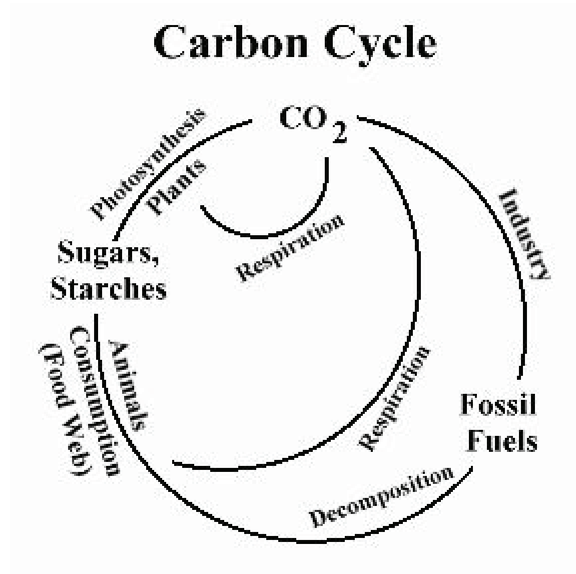
Energy produced from woody biomass is considered to be a renewable source. But unlike other renewable sources (e.g., wind and solar power), biomass energy production does emit carbon dioxide (CO2), a greenhouse gas. The difference between biomass energy and that produced from non-renewable sources such as oil and gas relates to the balancing of CO2 emissions and uptake in the carbon cycle.

The combustion of fossil fuels releases carbon that was stored underground into the atmosphere causing a build up of CO2, a greenhouse gas. When woody biomass from a sustainably managed forest is used to create bioenergy, carbon is recycled between the atmosphere and the forest. This is because the amount of carbon released into the atmosphere by burning wood for energy is balanced by carbon uptake over time as the forest regenerates and grows.

What is the carbon cycle?

The ‘carbon cycle’ is the cycle by which carbon is exchanged between the atmosphere, terrestrialecosystems, the ocean, and the earth’s sediment, crust and interior. The balance of the exchanges of carbon between reservoirs is influenced by both natural processes (e.g., plant growth, decay and natural disturbances) and human activities (e.g., extraction and use of fossil fuels).

For more information on the carbon cycle, visit www.woodforenergy.ca.



Some emissions of carbon do occur while producing bioenergy from woody biomass. These emissions are associated with fossil fuels used during harvesting operations, the transportation and processing of biomass, and the construction of facilities for conversion of biomass to energy. The total or net carbon emissions from the production of energy using biomass are still considerably less than those from non-renewable sources such as gas, oil and coal. This is demonstrated in Table 1 that shows the net carbon dioxide emissions from producing the same amount of energy from different sources.

Conversion from a gas or oil-fired combustion system to wood can reduce net CO2 emissions by a significant amount (depending on how much of the fossil fuel use is displaced) with a positive impact towards moderating climate change.

Net Carbon Dioxide (CO_2) Emissions from Energy Production[1]

Energy Source	Grams of CO_2 per Kilowatt hour (g/kWh)
Wood Fuel	25
Wind	8
Gas	194
Oil	265
Coal	291

[1]England Forestry Commission (undated). A guide to small-scale wood fuel (biomass) heating systems. Coordinated Woodfuel Initiative. 18 pages.

What Sources of Woody Biomass are Available for Bioenergy Projects?

Woody biomass for bioenergy production can come from a variety of sources including mill and harvest residues and standing timber. Mill residues are waste products from primary processing and include: tree bark removed prior to sawing; sawdust and shavings; and, slabs and offcuts. Forest harvesting operations can also generate residues including treetops and limbs, and trees removed in thinning operations. Standing timber suitable for biomass energy production includes low quality wood, and wood from fast growing plantations. All of these biomass sources may be processed into pellets, chips or used whole, and are often referred to as biomass feedstocks.

The availability and cost of the range of woody biomass feedstocks for bioenergy production depends on the current demand, feasibility of removal, transportation and any existing regulations. Most mill residues are currently used in the production of other products or bioenergy. This relates to the high potential for biomass use for on-site energy production by mills and the demand from other industries (e.g., for use as horticultural mulch and livestock bedding). Availability may change as the industry recovers.

In many regions of Canada, mill residues will not be a readily available source for new bioenergy projects. This has prompted a shift towards biomass sources harvested directly from the forest. In the case of harvest residues, environmental regulations and concerns as well as the technical and financial limitations of accessing, collecting and transporting the materials currently limits their use. However, harvest residues remain the feedstock of choice because of the cost of processing standing timber.

A biomass market for trees removed during pre-commercial thinning and low quality trees removed during harvest operations may evolve as fossil fuel prices increase, and there is additional investment and government support for bioenergy production. This market will be dependent on the markets for higher quality forest products, and has the potential to help offset the costs of sustainable forest management activities that contribute to overall forest health.

Harvest of Biomass from Mountain Pine Beetle Infested Areas of British Columbia Could Reduce Fire Risk and Promote Regeneration

Through British Columbia's Mountain Pine Beetle Action Plan, the government is exploring opportunities to make damaged timber available to biomass facilities.

continued on page 12

The mountain pine beetle has infested more than 8 million hectares of B.C.'s forest and it is predicted that approximately 90% of the merchantable pine in central and southern B.C. will be killed over the next five years. Harvesting the affected trees would provide a significant energy resource while helping to restore the forest, reducing fuel loads for fire, and promoting regeneration.

British Columbia Land Management Bureau. 2010. Independent Power Production in British Columbia: An Interagency Guidebook for Proponents. Province of B.C. 152 pages.

Is All Woody Biomass of Equal Value for Bioenergy Production?

Because of the great variation in woody biomass sources, the quality of fuel produced can be quite variable. Different biomass energy systems have different fuel specifications and tolerances to variation, so it is important to match the right fuel source and quality to the specific system. This is most important for smaller systems.

Properties such as moisture content, mineral composition, fuel size and density, and tree species affect the performance of a woody biomass fuel source:

Moisture content:
The amount of moisture contained in woody biomass impacts its heating value. Fresh or green wood is about half water by weight and, when it is burned, much of the heat energy is used to heat and evaporate water. For this reason, lower moisture content is usually preferable for biomass energy production. Ideally this would range from 30 to 45 percent for most combustion systems, but biomass systems can generally handle moisture content ranging from 15-50%. Wood pellets systems benefit from processing and drying to a uniform size and moisture content of only 5 to 6 percent. Very dry fuels can also cause problems, generating dust and increasing particulate emissions. Moisture content also affects fuel handling during cold weather and transportation costs (water increases weight).

Mineral composition:
The composition of woody biomass will also affect the efficiency of combustion. Ash is produced from naturally occurring minerals within the biomass, along with any debris on the fuel picked up during harvest. Ideally in a combustion system, ash remains in a powdery form. However, the presence of silica and alkali minerals in ash (e.g., sodium, sulphur, potassium and chlorine) can cause problems during combustion, melting and fusing to machinery and affecting overall efficiency. Ideally ash content should be less than three percent and becomes most problematic when it exceeds eight percent. Table 2 shows the range in ash content produced by various biomass fuel types. Ash content is a larger problem when using grasses and field crop residues than wood. However, the use of bark in woody biomass energy facilities may also cause problems.

Fuel size and density:
The size and density of woody biomass fuel particles will also affect the efficiency of burning, along with efficiency of transport, storage and handling.

Tree species:
The type of tree that woody biomass comes from can also affect its fuel value. Softwood species tend to have slightly higher moisture content and lower wood density than most hardwood species. Hardwood species have a marginally higher heating value per dry pound than softwoods.

Woody biomass may be processed or pre-treated to make it more suitable for bioenergy production. This includes processes such as drying, chipping and pelletization.

Wood is dried to optimize the combustion process and minimize emissions that may result from incomplete combustion. Dry wood has a greater energy value per unit weight than wood with greater moisture content. Drying wood may also make wood more suitable for storage.

Wood chips are usually produced from harvest residues and solid wood. Pelletizing or briquetting is a process that compresses wood residues such as sawdust into small pellets or larger briquettes increasing bulk density, providing uniform feedstock size and moisture content.

Both chipping and pelletization improve the efficiency of handling and transportation. Biomass combustion systems have been developed to handle a wide range of woody biomass fuel types covering a range of fuel sizes, moisture contents, and ash contents. It is important to give each of these fuel attributes careful consideration when investigating fuel availability and cost, and the design of woody biomass energy systems.

Ash Content in Various Biomass Fuels

Fuel Type	**Ash Content (as wt% (d.b.))**
Bark	5.0-8.0
Woodchips with bark	1.0-2.5
Woodchips without bark	0.8-1.4
Sawdust	0.5-1.1
Waste wood	3.0-12.0
Straw and cereals	4.0-12.0
Miscanthus (perennial grass)	2.0-8.0

Notes: Ash content measurement according to ISO 1171-1981 at 550 deg. C.Wood product ash values range from soft wood (lower ash content) to hard wood (higher ash content).

New York State Energy Research and Development Authority. 2009. Guide for Siting Small-Scale Biomass Projects in New York State. Final Report 09-07. 163 pages.

For more information on characteristics of woody biomass fuels, visit the CMFN bioenergy website www.woodforenergy.ca

Heat, Power and Combined Heat and Power from Woody Biomass

There are multiple technologies available in North America for the conversion of woody biomass feedstocks into energy. The energy produced may be in the form of heat or electricity, and systems may be integrated for the production of combined heat and power (CHP). CHP is also referred to as cogeneration.

There are advantages and disadvantages associated with the production of heat, power and CHP in small to medium or community scale systems. Table 3 outlines some of these considerations. Table 4 summarizes the fuel use and efficiency of biomass energy facilities of a range of sizes.

Biomass systems are available to support a variety of small to large scale projects and have been used in facilities such as schools, colleges, universities, hospitals, government buildings, hotels, commercial buildings, greenhouses, agricultural operations, manufacturing plants and community district energy systems. District heating and cooling systems can serve multiple buildings in a community using 'mini-grid' which consists of a central unit and an underground network of pipes that distribute thermal energy in the form of hot water, steam or chilled water.

While these systems are available and have been applied in Canada with demonstrated success, barriers still exist to widespread application. This often relates to high initial investment and long-term commitment for payback on project costs (particularly in commercial sectors) as well as the competitiveness with non-renewable energy sources, and supporting government policy and incentives.

Case Study: Lumber Mill Uses Sawmill Residues to Produce Combined Heat and Power in Nova Scotia

Taylor Lumber Co. Ltd produces between 8 to 10 million board feet of kiln dried and heat-treated lumber per year. Sawmill residues provide the biomass for power production including steam for the kiln and power for operations. Surplus energy is sold to a utility company.

The wood-fired power plant accepts biomass in a range of sizes (from sawdust to wood waste up to 6 inches long) and accepts both dry and wet materials (up to 65% moisture content). The plant produces about 1,000 to 1,150kW of electric power per year consuming 21,000 to 25,000 wet tons of biomass. The bioenergy system produces 20,000 lbs/hr of saturated steam at 230 psig using a KMW Biomass Energy System.

Taylor Lumber Biomass: Middle Musquodoboit, Nova Scotia.
http://cleanenergy.gc.ca/international/project_e.asp?item=207

Table 3. Advantages and disadvantages associated with the production of heat, power and CHP for consideration in woody biomass energy projects.

Bioenergy Production Type Using Woody Biomass

Heat – uses combustion technologies and hydronic boilers or low pressure steam systems to heat through larger buildings, schools, hospitals, industrial buildings, or in district heating systems. Emerging technologies include gasification and the production of pyrolysis oil.

Advantages

Efficient combustion technology is available for community applications (commercial and district heating) systems

Reduced CO_2 emissions along with nitrogen oxide and sulphur dioxide by displacing fossil fuels

Greater efficiencies in producing district heat (for multiple buildings) than through individual heating

Energy security, with locally available woody biomass sources

Disadvantages

Long term commitment is required to see returns on investment (high capital expenditures)

Less attractive for communities with low population densities

Investment in infrastructure to sell the heat

Potential for heat loss during distribution

Additional costs associated with provincial regulations of steam boilers (require high level of operator skill and attention)

Combined heat and power (CHP) – generate both heat and electricity using a combustion system and boiler with a steam turbine or Organic Rankine Cycle turbine for district heating or industrial scale applications.

Advantages

Generally have greater fuel use efficiency than when power is produced alone (more energy from the same type of fuel through heat capture)

Energy security, with locally available woody biomass sources

Reduced CO_2 emissions along with nitrogen oxide and sulphur dioxide by displacing fossil fuels

Disadvantages

Smaller scale systems are not commercially available

Long term commitment is required to see returns on investment (high capital expenditures)

Requires even greater investment than heat production only due to the complexity of integrating heat and power systems.

Investment in the 'heat loop' for district heating adds additional costs in the range of $500 to $1000 per metre

Lack of interconnection standards (rules and net metering) can create difficulties for connecting to the grid

Maintenance costs can be greater for CHP than heat-only systems

Additional costs associated with provincial regulations of steam boilers (require high level of operator skill and attention)

Operates at a lower generating efficiency than large central power station

Poor part-load performance

Scale of plant influences rate of return (smaller scale CHP plants produce energy more expensively than larger scales)

Continued on page 12

Power – generates electricity for distribution to the wider geographic grid, or for onsite use with potential to sell excess to the grid

Advantages

Smaller generation plants for on-site use or with a restricted geographic distribution (distributed power) can provide energy security

Reduced CO2 emissions along with nitrogen oxide and sulphur dioxide by displacing fossil fuels

Co-firing woody biomass with fossil fuels in larger applications can achieve low-cost emission reductions

Disadvantages

Loss of heat capture reduces efficiency compared to CHP

Lack of interconnection standards (rules and net metering) can create difficulties for smaller projects in connecting to the grid

Long term commitment is required to see returns on investment (high capital expenditures)

Table 4. Fuel use and efficiency of heat, power and combined heat and power facilities.

Bioenergy type	Size (MW)	Fuel use (green ton/year)	Efficiency %
Power			
Industrial	2-25	10,000-150,000	20-25
School campus	N/A	N/A	N/A
Commercial/Institutional	N/A	N/A	N/A
Heat			
Industrial Plant	1.5-22.0	5,000-60,000	50-70
School campus	1.5-17.6	2,000-20,000	55-75
Commercial/Institutional	0.3-5.9	200-20,000	55-75
CHP			
Industrial Plant	0.2-7 (2.9-4.4)[1]	10,000-100,000	60-80
School campus	0.5-1(2.9-4.4	5,000-10,000	65-75
Commercial/Institutional	0.5-1(2.9-7.3)	5,000	65-75

1 Size for CHP are a combination of electrical and thermal respectively.

Adapted from: USDA Forest Service. 2004. Wood Biomass For Energy. Forest Products Laboratory. TechLine. 3 pages. www.fpl.fs.fed.us/documents/techline/wood-biomass-for-energy.pdf.

Biomass Conversion Technologies for Heat and Power Generation

The simplest and most common way to convert woody biomass to energy is to burn it. The combustion process combines oxygen in the air with the biomass fuel to produce heat, carbon dioxide and water. The amount of heat produced during combustion depends on both the chemistry and moisture content of the fuel.

The technologies described in this section focus on woody biomass conversion through combustion, recognizing that there are other technologies available and emerging that can be used to convert biomass to liquid or gas biofuels. Woody biomass can also be used to produce chemicals not directly used for bioenergy.

Most biomass energy systems consist of a furnace or combustion unit that supplies heat to a boiler. Water and steam from the boiler can be used directly for heat or passed through a steam turbine generator to produce electricity. In facilities where air is distributed for heat, an exhaust gas to air heat exchanger would be used instead of a boiler.

Existing combustion technologies include:

Grate systems (also called fixed bed or stoker systems):
An automatic feeder is used to feed the fuel onto a grate. Combustion air enters from below the grate to provide oxygen for burning the solid biomass. Air also enters from above the grate to ensure complete combustion of wood gases and minimize atmospheric emissions. In a fixed grate system, ash falls into a collection pit and is removed. In a moving grate system ash is dropped into a hopper. Systems may have vibrating or rotating grates to re-distribute fuel and improve combustion efficiency. These systems require a lower capital investment and have lower operating costs than other combustion technologies, however efficiencies are often lower and there is less tolerance for variation in fuel source (e.g., particle size and moisture content).

Fluidized bed systems:
This is the most recent type of boiler developed for solid fuel combustion. It burns fuel on a hot bed of inert, incombustible material such as sand. Air is injected up through the bed suspending the material in a floating or fluid state. The fluid movement of the bed allows oxygen to reach the biomass more readily and increases combustion efficiency. These systems have a much higher investment cost than grate systems and may only be cost-effective in larger installations. They have higher combustion efficiencies, operate at lower temperatures reducing nitrogen oxide emissions, and they can handle a variety of fuel sources including high ash, stringy fuels and agricultural residues.

Suspension and cyclone burners (also called pulverized fuel systems):
This technology has been widely used in coal-powered facilities and only recently adapted for woody biomass fuels. The fuel requirements for these systems are very fine particles (6mm or smaller for suspension burners and 3.5mm or smaller for cyclone burners) with low moisture content (15% for suspension burners and 12% for cyclone burners). Fuel is blown into a combustion chamber and suspended by forced air or centrifugal force. Because of this suspension, ash is expelled from the combustion chamber with the flue gas and then separated in a separate chamber. These systems have high efficiencies, however the benefits of efficiency may be offset by higher fuel and operation costs.

Pile burners:
This is an older technology that will not apply to new biomass systems except in systems where coal-fired pile burners are adapted to allow co-firing with woody biomass. Biomass fuel burns on a grate in a lower chamber releasing gases that burn in an upper chamber. Co-firing with woody biomass also works in suspension and cyclone systems and grate systems.

Whole-tree burners:
This is a newer technology that is still at the demonstration stage. It uses a combustion system similar to a pile burner and is large enough to burn wood segments of up to 20 feet, eliminating the need for wood chipping or pulverizing.

The suitability of a combustion technology to a project will depend on both the scale and energy needs of the project and the long-term availability, cost and quality of woody biomass feedstocks. System sizing of the furnace will be critical to optimize efficiency. The boiler (heat exchanger) must also be properly sized to minimize heat losses to the chimney. Researching available fuel sources and qualities (e.g., moisture content, mineral composition, sizing and density) and the potential need for system adaptability to variation in fuels will also be critical in technology selection.

Other critical infrastructure for consideration in a biomass heating or combined heat and power facility

Storage capability: The size and type of storage facility will be dependent on fuel requirements and availability. Drying facilities using process heat may also be used on site.

Roads/ driveways: To provide access for fuel delivery trucks.

Fuel handling and feeding systems: To feed fuel from the storage area to the combustion system. Systems can be automated/semi-automated

Chimney: To disperse combustion gases. Biomass systems may require a taller stack than oil or gas systems. Emissions control systems may also be installed to reduce particulate emissions.

Back up generators: Allows for maintenance and increases reliability.

Water purification: On-site systems are necessary to clear minerals and salts from water.

Electric interconnection: If electricity is produced, will it serve the facility and/ or provide excess energy to the grid? Success in connecting to the grid will depend on the regulatory environment in the region and the potential interest of the local utility in contracting independent electricity producers.

Electricity can be generated in a combined heat and power system with the addition of a steam turbine. The most commonly used turbines are back-pressure turbines (suitable for small scale electricity generation) and extraction turbines (suitable for electricity generation greater than 5 MW capacity). An alternative technology for electricity production is an Organic Rankine Cycle (ORC) system, which uses organic oil or refrigerants rather than water to transfer heat to the boiler and power conversion system. The advantage over a steam system is the ability to operate at lower temperatures and increased efficiency. It should be noted that various provincial regulations require steam-based systems to be supervised 24 hours a day by a certified operator, which can add significantly to project costs. Boiler regulations also impact the use of some European technologies in Canada.

Other emerging technologies are developing to convert woody biomass into fuel for heat, electricity and liquid fuel. Gasification is a process where biomass is heated to high temperatures in an oxygen-starved environment, producing ash and synthesis gas or syngas. Syngas is a mixture of carbon monoxide, hydrogen and methane and could be combusted in a steam or other power cycle, or used in place of fossil fuels in industrial processes.

What is a Megawatt (MW)?

A megawatt is a unit for measuring power that is equivalent to one million watts (equivalent to one joule per second or 3,413 Btu/hour). A kilowatt (kW) is equivalent to 1,000 watts.

Different biomass fuels have different energy densities. For example, one kilogram of wood chips could produce two to four kW of electricity per hour (dependent on moisture content). 1 One kilogram of wood pellets can produce 5 kW of electricity per hour.1 It is estimated that 14,000 tonnes of dry wood would be required to produce one MW of electricity per year.[2]

1 England Forestry Commission (undated). A guide to small-scale wood fuel (biomass) heating systems. Coordinated Woodfuel Initiative. 18 pages.

Case Study: Alberta Forest Research Institute Tests Gasification Unit For Combined Heat and Power from Biomass Fuel

The Alberta Forest Research Institute has been measuring the performance of a demonstration unit built in Colorado for combined heat and power. The unit converts chipped biomass into a combustible syngas through gasification. The gas is then cooled and used in a diesel engine that drives a generator with some supplementary diesel. The unit generates 50 kilowatts using one tonne of feedstock per day, which translates to enough power for 10 to 20 houses. Heat from the generator is also captured for space heating.

Holehouse D. 2009. AFRI support fuels bioenergy tests. Septmber 1, 2009. www.mediamatchwest.com.

Gasification technology is still in early phases of demonstration, but there is considerable interest in refining the technology, as fuels in a gaseous state are more versatile than solid fuels (for both use and transportation). There is also potential for reduced emissions using gasification systems, which can process a range of biomass feedstocks.

The production of pyrolysis oil as an energy carrier is emerging in Canada. The process heats biomass to very high temperatures (400-600 oC) in the absence of oxygen, producing gas and char. Pyrolysis oil is produced through the condensation of gases formed in the process. The chemistry of the bio-oil varies depending on the type of feedstocks used in the process. The process requires biomass feedstock with low moisture content to reduce water content in the bio-oil. The bio-oil is very acidic and has a lower energy value than petroleum fuels but can be used in applications such as boilers, furnaces, engines and turbines.

For more information on emerging technologies visit the CMFN bioenergy website:

www.woodforenergy.ca

Challenges for Woody Biomass Heat and Power Production in Canada

The demand for bioenergy has been slow to develop in Canada compared to European countries because of Canada's low non-renewable energy prices. Canada has significant reserves of non-renewable resources like coal, oil and gas and has made a substantial investment in the infrastructure and jobs associated with those industries.

While the Canadian forest industry has led the way at the industrial scale in the conversion of wood residues to energy for use in the paper and wood products industries, the supply chain for woody biomass for energy remains undeveloped and the forest industry lacks capital to further invest in projects on its own. Investors in new bioenergy projects will likely come from outside of the forest industry, but they will look to the industry for a long-term and affordable biomass supply. The extraction and processing of wood at an affordable price to supply biomass energy projects is one of the greatest challenges to the production of energy from wood in Canada.

Why is Biomass Energy More Competitive in European Countries?

In Europe, where energy prices are high, biomass energy is a more competitive source of heat and power. Public policy around carbon credits and trading, and government support for renewable energy projects, has made biomass energy economically feasible and more common in European countries. In Canada, there is still uncertainty surrounding industry regulation and market demand, along with a less developed carbon market, making biomass energy a lower priority.

It is anticipated that the current challenges to producing bioenergy from wood will start to shift as the price for fossil fuels rises beyond a certain threshold. Emerging government policy in response to both energy security and the need to mitigate climate change impacts will also influence biomass energy production in the future.

There are some current policies and incentives that support biomass energy production in Canada. Federal government programs are geared towards incentives for research and development and demonstration of green technologies, however financial support is mostly limited to the development phase. Some provincial governments have established policy and legislation in support of renewable energy, and provincial jurisdictions are responsible for regulations surrounding forest management, land use and tenure, and environmental quality. These regulations build the framework from which biomass energy opportunities are considered. Municipal zoning and permitting requirements also contribute to this framework. Some municipalities have also developed air quality and climate change action plans for implementation at a community level.

For more information on government policies and programs, visit the CMFN bioenergy website:

www.woodforenergy.ca

Looking to the future, as the demand for renewable energy grows woody biomass is positioned to provide a significant energy source. Interest in biomass energy is growing in Canada, driven by environmental considerations (reduction of greenhouse gas emissions) and socio-economic considerations (rural economic development and jobs). The technology is available for small to large-scale biomass energy projects, and the cost for biomass fuel remains low compared to fuel oil on a Btu basis (a standard measure of heat – British Thermal Unit). Government support through policy and incentives still varies considerably by region however, and often focuses on the potential for electricity and not the potential for heat or combined heat and power. While biomass energy projects currently receive only a fraction of the attention that other renewable projects have received by government and financial investors, the growth of these other industries should benefit the biomass energy market over the longer term.

Despite these limitations, successful biomass heat and combined heat and power projects are occurring in all regions of the country. Several case studies are included throughout the text of this document.

For additional Canadian biomass energy case studies, visit the CMFN bioenergy website:

www.wood4heat.ca

Economic Feasibility

Developing the Idea

Bioenergy options for communities need to be evaluated based on community capacity and need. A range of information is available from energy companies, non-profits and government agencies, and it will be critical for any community considering a project to evaluate opportunities carefully to ensure environmental, social, and economic benefits can be realized and risks mitigated.

The development of a woody biomass energy project takes a lot of time and energy and will happen in a series of stages. A project champion or leader is required to get the ball rolling: identifying the potential opportunities; investigating incentives; building partnerships with community leaders and private industry; and, investigating the availability of woody biomass feedstock sources. Important questions for a community to consider in the initial stages of developing the idea are listed in the text box on this page. The CMFN decision support tool 'A Bioenergy Options Evaluation Module for Communities' will also be developed to help communities with decision-making at this stage.

Engaging communities and stakeholders from the beginning and at all key stages of the project's development is critical to generate both community support and identify potential problems and concerns. Community concerns over environmental and social issues such as air quality impacts, transportation routes for biomass supply, and sustainability of biomass harvest need to be addressed in the early stages of the project as they may affect project costs and potentially project feasibility.

Sharing information about the project and its potential benefits and impacts will facilitate informed discussion within the community that may lead to mitigation of risks. A formal consultation process with provincial and federal agencies, local governments, First Nations, the public and other stakeholders may be required for larger projects.

Getting Started: A community readiness checklist for bioenergy projects

Community Support:

- Is there a project champion?
- Is there community interest in biomass energy?
- Is there a mechanism to communicate potential benefits to community members?
- Can potential partners be identified (e.g. private sector, municipal or provincial governments, non-governmental organizations)?
- Are the skills and human resources available in the community to deliver the project?
- Is there a governance structure or organization in place to deliver the project?
- Would the project benefit from the development of a cooperative?
- Are there other groups that have successfully completed biomass energy projects in the region?

Continued from page 20

Biomass Resources:

- What types of biomass resources are available?
- Is there an existing market for biomass?
- Is biomass currently being harvested and used in the area?
- What type of harvesting is used on site?
- Is there a mechanism (e.g., logging company) to organize biomass supply?
- Is biomass locally available and reliable over the long-term?
- What are the estimated delivered costs of biomass?
- Is there a framework for sustainable management?

Market/Financing:

- Have key facilities or district energy customers been identified?
- Are there existing financial incentives that will help offset project costs?
- Is it possible to hook up to the provincial electricity grid?
- Are financial resources available to get the project started (e.g., feasibility assessments, business planning, community engagement)?

Pre-feasibility Assessment

Once the opportunities, interest and level of local support are identified, a pre-feasibility study can provide a preliminary assessment of the viability of biomass opportunities. A preliminary project plan outlining prospective sites, technologies and plant size, and resource availability will assist in this analysis. Information regarding existing or estimated utility costs and heat requirements for facilities to be served by the project should also be gathered. It is important to get help at this stage from an experienced consultant or contractor, as this step is critical to help prepare the community for potential funding opportunities.

The main financial driver for biomass projects is the savings over time in fuel costs. A pre-feasibility study investigates whether the fuel cost savings will justify the total cost of the project over time. A calculation of simple-payback period can give a rough estimate of the cost effectiveness of a project. An estimate of total project costs divided by annual energy cost savings gives an estimate of the time required to pay off the investment. A pre-feasibility study can answer a lot of questions and provide an assessment of whether conversion to woody biomass energy is a potential option for a community.

Case Study: Tsilhqot'in Bioenergy Project Facilitates Joint Venture

The Tsilhqot'in community is located in the Chilcotin area of British Columbia. This area is projected to have a 20-year supply of timber damaged by the mountain pine beetle. The Band has entered into a 50/50 joint venture with Western Biomass to create a power project that fits with their community values.

Community engagement included 30 community meetings held in English and the Tsilhqot'in language. Data from traditional use studies was integrated into planning including culturally sensitive areas. And values such as water, salmon, steelhead and woodland caribou were identified in the design.

The project, which has been submitted to BC Hydro's Bioenergy call, will generate 60MW of power with capital costs of $260 million and annual operating costs of $60 million.

Sutherland K.A. (editor). 2010. Bioenergy solutions for community sustainability: after the Mountain Pine Beetle: Developing an Economic Base for the Future. Workshop Proceedings. FORREX. 49 pages.

The Business Plan

The success of any biomass energy project depends on good business planning. A project plan should define: project goals; potential sites; biomass resource availability; scale of installation; and, technologies to be used. Developing a comprehensive business plan will ensure the project team and partners look at the project strategically and objectively and identify risks to moving forward. It will also provide a roadmap forward with respect to marketing and financing, and identify potential barriers. It is critical to enlist the support of qualified professionals at this stage including accountants, lawyers and engineers.

It is also important to investigate permit requirements at this stage of planning to guide the design of the project. Projects often require permits from a range of government agencies. Compatibility with municipal planning and zoning may also be an issue and, for larger projects, an environmental impact assessment might be required. Investing the time at the beginning of the project to develop working relationships with local agency representatives will minimize project costs and the potential for delays.

Once a pre-feasibility assessment has been completed, building community and stakeholder confidence in the project, a full feasibility study should be completed as a contribution to the business plan. This involves a site visit and input from professionals such as a system vendor or mechanical engineer to put together equipment specifications, and layout a plan for the facilities.

A life-cycle-cost analysis forms a more comprehensive assessment to support the business plan. It estimates the total costs of a project over its lifespan and should be conducted with the assistance of an experienced consultant. The analysis compares project costs of an existing system to the projected costs of a new woody biomass energy system. The output is the value of the potential additional costs or savings over the life of the system. Detailed budgets including costs for feedstock, system design and construction, operations management and potential repairs, maintenance and fuel for back-up systems, financing and permitting will be required for a more detailed financial analysis. A life-cycle-cost analysis also considers inflation and rate of escalation in fuel prices.

The outcome of a life-cycle-cost analysis is an indication of which system will be a better financial investment. If the woody biomass energy system is not proven to be financially viable, the results of the analysis can still be used to investigate the potential for future applications under different fuel prices through sensitivity analysis.

A strong business plan will document the inputs and outcomes of the feasibility analysis and will be a critical element supporting applications for financing. Incentives may be available through provincial and federal programs to offset project costs and support a financial application.

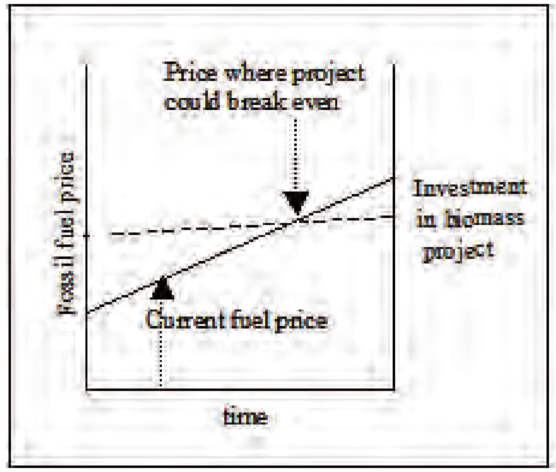
The estimated potential costs for woody biomass heat and CHP technologies range considerably. A medium scale commercial heat only facility in the 100 to 800 kW range might cost $75,000 to $150,000 dollars. Larger scale heat only facilities can range in price from one to two million dollars. A medium sized organic rankine cycle (ORC) combined heat and power application generating one MW of electricity and 7 MW of thermal heat might cost in the range of 8 million dollars. Larger scale steam systems (e.g., 7 MW electricity and 30MW thermal power) would cost in the range of 40 million dollars. These are estimates only and will vary based on the individual nature of a project. The need for reliable, accurate data associated with individual projects for a feasibility assessment cannot be emphasized enough, as this step is critical to justify these kinds of investments in bioenergy infrastructure.

RETScreen: A Decision Support Tool for Feasibility Analysis

Several life-cycle-cost analysis tools are available to assist in decision-making with respect to renewable energy technologies. Many are proprietary, but Natural Resources Canada offers a free software system called RETScreen to assist in feasibility assessments. RETScreen Clean Energy Project Analysis Software is a unique decision support tool developed by experts from government, industry, and universities to evaluate the energy production and savings, costs, emission reductions, financial viability and risk for various types of renewable-energy technologies. The software is available for download at http://www.retscreen.net.

Sensitivity Analysis

A sensitivity analysis can be used to determine how sensitive the results of the life-cycle-cost analysis are to changes in the input variables. For example, the following simplified graph illustrates the point at which the influence of increasing fossil fuel prices might make a biomass energy system viable..



Woody Biomass Feedstock Supply

Bioenergy systems can use 10's to 100's of thousands of tonnes of woody biomass per year. Consequently, identifying a reliable supply of affordable woody biomass feedstock is one of the most critical elements in project planning. Reliable fuel supplies need to be secured early in the development of a project and fuel prices must be determined for the life-cycle-cost analysis and business plan. This will be critical information to justify capital investments in infrastructure, determine the project payback period and obtain financing.

In the past, most of the woody biomass material used for community bioenergy systems has come from sawmill residues. In recent years, demand for these fuels has grown, but supply has decreased due to the downturn in the forest products industry. As demand for woody biomass increases, the majority of fuel for new systems will likely come from harvested low-grade wood from the forest. The sustainability of this fuel supply is an important consideration for new biomass energy projects. To address this, a woody biomass inventory should be conducted to ensure there is an adequate volume on the local landscape to support the investment in the project. The assessment should also consider what portion of that volume is accessible, available, reliable and affordable over a long-term basis to supply biomass to the energy project.

Several factors influence woody biomass supply:

Efficiency of harvest:
Efficient harvest of low value forest biomass is dependent on a healthy forest sector. Using wood for energy is one of the lowest value uses of forest biomass. A healthy forest sector in which markets for low value biomass are supported by markets for high value products such as sawlogs will increase efficiencies in harvesting of wood for biomass energy and generate opportunities to re-invest in long-term sustainable forest management.

Coordination and planning of the woody biomass supply chain:
The costs associated with coordination and planning of harvest, transport, processing,

sales and distribution make it challenging to generate a profit from woody biomass removal. This is even more critical in Canadian forest regions where the volume of biomass per hectare is lower. Less volume of biomass per hectare results in a greater expense to generate energy from biomass.

Existing framework for environmental protection:
Regulations and guidelines for sustainable forest management protecting other forest values including soil and water quality and wildlife habitat restrict the availability of low quality wood and residues that may be removed from the forest on Crown lands. Private lands have fewer restrictions, but stewardship is encouraged through uptake of best management practices. Voluntary certification systems on Crown and private lands also influence retention and environmental protection.

Landowner goals and objectives:
Landowner management objectives also influence biomass availability from private lands, with a portion of non-industrial woodlot owners focussing on other forest values such as conservation and/or recreation, with less interest in the potential for income from harvest on their properties.

Competition with other markets:
will also influence prices and long-term supply.

Fibre sources need to be secured over long time periods using contracts with local landowners, mill operations, or companies holding licenses to harvest trees to make woody biomass energy operations competitive. From a community perspective it will be important to ensure that there is both an adequate volume of biomass available over time, but also that it is accessible and affordable over the long term. Biomass can be processed on the harvest site, and/or at a separate facility with implications for transportation costs. Factors influencing decisions on processing include customer operating system requirements for material, total biomass volume, and road quality and access conditions to the site.

Building long-term relationships with woody biomass suppliers will be critical to the success of a project, and may also be beneficial to the suppliers as they invest in capital (e.g., chippers) to support their operations. Pooling the demand for biomass resources with other consumers may also help suppliers by aggregating volumes necessary to support a profitable business.

While communities have little control over stand level management, they can influence the long-term sustainable management of forest resources by setting community objectives or standards for woody biomass supply. Setting objectives to use wood from local sources, harvested by accredited loggers, from areas with management plans approved by a professional forester, and/or from third party certified sources could contribute to the protection of a range of forest values across the broader regional landscape.

Environmental Considerations

Bioenergy and Forest Sustainability

Forests are associated with a range of values – both ecological (e.g., carbon storage, air quality protection, ground water recharge, erosion and flood control, protection of water quality and quantity, and wildlife habitat) and economic (e.g., forest products including those used for energy production). Sustainable forest management considers this range of values, balancing economic and societal needs while maintaining the ecological foundations of the forest ecosystem.

Standing timber harvested in forest management operations can be used for traditional dimensional wood products, value added products, pulp, manufacturing, or energy stock. Other by-products from harvest have also been used for biomass energy production (e.g., crowns, branches, small diameter trees). Biomass harvesting is usually included as part of an integrated harvest where multiple products are removed at the same time. When harvests are conducted using the existing framework of provincial regulations and guidelines, or best management practices, impacts to other values should be minimized.

Case Study: City of Revelstoke Fuels Biomass District Heating System With Sawmill Wood Residues

Local volunteers in Revelstoke B.C. developed the Revelstoke Community Energy Corporation in 2001 with the goal of using sawmill and other wood waste to create community energy. A biomass boiler was installed with the goal of providing heat for drying lumber at the sawmill, and providing hot water to a community energy system for buildings in the city core.

The goal of the project was to improve air quality and reduce greenhouse gases, as well as to reduce the need for propane. Total investment in the project was $6.6 million, and heating capacity output is 1500 kW or 5.1 million Btu.

Biomass Energy Resource Centre. 2009. City of Revelstoke, British Columbia, Canada: Mountain City Creates a New Fuel: Its Own Forests. Biomass Case Studies Series. 2 pages.

There are positive implications of an increasing biomass market for forest managers and industry. An improved market for low quality trees and residues could offset the cost of forest management activities (e.g., thinning to reduce wildfire risk, restoration and enhancement of wildlife habitat, and management of insect and disease infestations) and silvicultural treatments, such as pre-commercial thinning. With the decline in demand for pulp from paper mills, some areas of the country no longer have markets for smaller diameter and low value trees. A biomass market for small-diameter and low value trees could encourage thinning to improve regeneration, stand health, and growth of the remaining trees. Energy crops, including hybrid poplar and hybrid willow, show promise as a viable bioenergy resource, and may provide environmental benefits and functions beyond biomass including soil remediation, erosion control, water protection, and carbon sequestration.

It is critical as bioenergy opportunities grow that forests are not over-harvested for fibre and that high value trees are not allocated to low value markets. As woody biomass energy becomes more widely adopted in Canada and the demand for wood and residues increases, it will be important to monitor and evaluate the impact of this additional pressure on forest ecosystems at both the regional landscape and stand level. In some regions, the increased demand will create opportunities and markets for wood that previously didn't exist, and in others the demand will compete with other existing uses.

Case Study: Yellowknife District Heat System Operates on Wood Pellet Boiler

The City of Yellowknife recently installed a 750kW wood pellet boiler that provides biomass heat to three municipal buildings: the local arena, curling club and pool. The buildings were previously heated with oil and the City has retained the original boilers as a back up system.

Installation of the wood pellet boiler has reduced greenhouse gas emissions from municipal operations by an estimated 20%. Cost savings on fuel in the first year were estimated at $19,000. Expected annual pellet usage is 590 tonnes. The equivalent annual oil amount is 300,000 litres.

Arctic Energy Alliance. Undated. Wood Pellet Boiler: Yellowknife Arena, Curling Club and Ruth Inch Memorial Pool. http://www.aea.nt.ca/uploads/files/wpd_-_yellowknife_-_yk_arena_&_rimp.pdf

There is concern that removal of small diameter trees, tops, limbs, and trees that have traditionally been considered as unmerchantable for biomass energy purposes increases the intensity of forest operations and potential for impacts on long term site productivity. The Canadian forest research community is investigating these impacts, analyzing existing data, conducting new forest trials and responding to the concerns of the environmental community. The impacts appear to depend both on site conditions and the amount and composition of biomass removed.

Some provinces and states have developed forest biomass retention and harvesting guidelines to support forest managers in decision-making with respect to biomass removal. Existing regulations for harvest on Crown land also address harvest volumes in some provinces. Improving new and existing guidelines and regulations with ongoing science and monitoring will be critical to ensure forests are sustainably managed as demand for biomass increases.

Forest certification may be another tool to ensure and monitor ecological sustainability of biomass harvest. Forest certification is a process where an independent third party assesses the quality of forest management in relation to a set of standards. While certification standards have not been developed explicitly for biomass harvest at this time, the standards provide a structure for monitoring and assessment, and provide assurance to stakeholders that forest management addresses the range of environmental, social and economic considerations. This is important as the claim of carbon neutrality of woody biomass energy hinges on the concept of sustainable forest management.

For additional Canadian biomass energy case studies, visit the CMFN bioenergy website:

www.wood4heat.ca

Other Environmental Benefits and Risks

The most obvious environmental benefit of bioenergy from wood is the displacement of the use of fossil fuels. The energy created from woody biomass from a sustainably managed forest has low net carbon emissions (see section 3.2). The conversion of mill residue and slash to energy, instead of burning for waste removal with no energy capture, also offsets fossil fuel use and greenhouse gas emissions.

Combustion of woody biomass fuels can affect air quality through emissions of particulate matter and other pollutants. The emissions are different from those associated with fossil fuels, with some decreasing and others increasing.

Table 5 provides a summary of emissions of four pollutants associated with combustion from fossil fuel and woody biomass sources. Emissions of sulphur dioxide (SO2), a pollutant that contributes to acid rain, are lower for woody biomass than for both oil and propane combustion. Woody biomass emissions of nitrogen oxide, a pollutant that combines with volatile organic compounds to produce ground level ozone, are comparable to oil. And emissions of particulate matter, carbon monoxide and total organic compounds are higher from wood than oil.

Using the best available emissions control technology, appropriate stack height and careful siting, will help to reduce local air quality concerns associated with woody biomass combustion for bioenergy. Industrial particulate matter control technologies can remove up to 99% of the particulate matter from biomass emissions and may be required for larger installations.

Impacts of biomass combustion projects on land use decisions, water use and air quality will all need to be evaluated on a site-specific basis for individual projects. Cumulative impacts and benefits from multiple projects should also be monitored over time.

Table 5. Emission Rates from Wood and Fossil Fuels1 (lbs/MMBtu).

Emission Type	Potential Impact of Emissions	Wood chip Boiler	Oil Boiler	Propane Boiler	Natural Gas Boiler
PM10	PM10 refers to par-. ticulate matter of 10 microns in diameter. It represents the combination of fine solids and aerosols in the air. PM impacts respiratory systems and forms smog when combined with ground level ozone	0.1	0.014	0.004	0.007
CO	Carbon monoxide is a poisonous gas	0.43	0.035	0.02	0.08
NO2	Nitrogen oxide combines with volatile organic compounds to produce ground level ozone.	0.165	0.143	0.154	0.09
SO2	Contributes to acid rain	0.0082	0.5	0.016	0.0005

1 These values are based on technology without emission control equipment (with the exception of PM10) and emissions are given on a heat input basis. Wood chip boiler emission rate values characterize wood fuel in general.

Adapted From: Biomass Energy Resources Centre. 2007. Wood Pellet Heating Guidebook: A Reference on Wood Pellet Fuels and Technology for Small Commercial and Institutional Systems. Massachusetts Division of Energy Resources.

Community Benefits

Implementing a woody biomass energy project provides a number of benefits to rural communities. Investment in biomass production and use directly supports local jobs in the forest products industry through the collection and processing of biomass. Biomass energy offers new opportunities to diversify the market for forest products, and strengthen the economic foundations of forest-based communities. It also brings a new skill base to the community.

Reducing the reliance on fossil fuels in some northern communities could reduce the costs of heating and electricity generation. There is also greater price stability associated with woody biomass than fossil fuels, such as oil and gas, which are linked to world energy markets. The money spent on energy from biomass sources also stays in the local eco-nomy, circulating through other local businesses and contributing indirectly to additional jobs and income.

The use of sustainably managed local wood resources for bioenergy provides an opportunity to offer a clean energy source and minimize the environmental and economic costs associated with transportation. While job creation and income improvement are likely the key drivers for community support, the added social and environmental benefits of reducing carbon emissions, environmental protection and security of energy supplies will also resonate with community members. Community district heating projects may result in air quality improvements in local communities, as a single plant replaces multiple boiler plants from individual buildings.

Case Study: St. Mary's Paper Corporation Signs Contract to Supply Wood Energy to Ontario Power Authority

St. Mary's Paper Corporation will build a biomass-fueled plant next to its existing mill in Sault Ste. Marie, Ontario by 2014. The primary biomass fuel source will be bark and waste wood, and generated heat will be used in the mill's industrial processes. The mill will use electricity generated from the project with the excess sold to the grid. St. Mary's Renewable Energy Corporation will run the plant and has negotiated a commitment of 400,000 tonnes of biomass annually from the Algoma and North shore Crown Forests for the life of the project.

Economic benefits to the region include 555 direct and indirect jobs associated with the project. This will revitalize the forest sector and create long-term job stability in the region.

Wood Biomass News. 2010. St. Mary's Paper Will Provide Wood Energy to Ontario Power Authority. November 9, 2010. http://www.woodbiomass.com/

Bioenergy projects provide a mechanism to promote sustainable management in local forests for multiple benefits including a range of forest products, recreation, water quality, wildlife habitat, and aesthetics. There is ownership in understanding where community energy is coming from and understanding the economic benefits for community members. Biomass energy opportunities may also give forestry professionals an opportunity to reconnect with private landowners and work with them to explore options to supply biomass and promote woodland stewardship.

The development of a biomass energy project within a community provides opportunities for local participation and capacity building. New partnerships and expertise may be transferable to other projects and initiatives.

Moving Forward

While the technology is available in Canada for woody biomass energy production, it has not been widely used in many regions at the community level. As discussed throughout the document, many barriers to implementation in Canada still exist including:

- High initial investment costs with long term commitment required for payback on project costs;
- Boiler regulations that impact the use of European technologies in Canada, and increase project costs;
- Technical and financial limitations of accessing, collecting, processing and transporting woody biomass materials; and,
- The need for further development of supporting policy and incentives relating to bioenergy production from wood.

Despite these limitations, there are some great success stories from across the country, some with considerable longevity. It will be important to build on lessons learned, and profile these examples, to demonstrate what is possible.

For communities interested in initiating a project, it may be useful to start with a small to medium scale project providing heat to a group of municipal buildings. The demonstration value of the project may facilitate financing and interest in a larger and more complex system.

Location of a reliable and affordable woody biomass feedstock supply will be a critical starting point for any new project. Communities should look to the existing forest industry to build partnerships.

For More information

Visit the Canadian Model Forest Network's 'Wood For Energy' website: www.woodforenergy.ca

Or contact the Canadian Model Forest Network:

PO Bag 2150 - Sac postale 2150
10 chemin Campus Drive
Kemptville, ON
K0G 1J0
613-258-8400
www.modelforest.net

Canadian Model Forest Network
PO Bag 2150, 10 Campus Drive,
Kemptville, ON K0G 1J0

www.modelforest.net

CANADIAN MODEL FOREST NETWORK

RÉSEAU CANADIEN DE FORÊTS MODÈLES